Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of 1998 Biennial Regulatory Review – Modifications to Signal Power Limitations Contained in Part 68 of the Commission's Rules	CC Docket No. 98-163

COMMENTS BY SOUTHWESTERN BELL TELEPHONE COMPANY, PACIFIC BELL, AND NEVADA BELL

I. Introduction

Southwestern Bell Telephone Company ("SWBT"), Pacific Bell, and Nevada Bell file these Comments on the Notice of Proposed Rulemaking ("NPRM") released September 16, 1998 in the above-captioned proceeding. The NPRM seeks to "somewhat improve the transmission rates experienced by persons using high speed digital information products, such as 56 kilobits per second (kbps) modems, to download data from the Internet." Accordingly, the NPRM "propose[s] to relax the signal power limitations contained in Part 68 of [the] rules and explore the benefits and harms, if any, that may result from this change."[1]

[1] NPRM at para. 1.

The proposal to increase the amount of signal power for data transmitted over telephone lines risks causing harm to transmission quality from distortion, including cross-talk, that would greatly outweigh the potential benefits to Internet users from a slight increase in data transmission speed.[2] It is premature to propose any change in network signal power. Before any change could be made without creating this substantial risk of harm, extensive engineering studies and testing would be needed, including substantial work in standards bodies. Without extensive testing, we cannot tell how increasing the signal power would affect our network transmissions.

In the mean time, there are alternative methods of increasing data transmission speed and throughput much more dramatically than by increasing signal power.[3] Moreover, other methods pose far less risk of distorting transmission quality. The Commission should not adopt the NPRM's proposal, but instead should encourage the exploration and development of various means

---

[2] If successful, the NPRM's proposal might increase the transmission rate for data from 54 kbps to 56 kbps. NPRM at para. 3. The NPRM points out, however, that 56 kbps is a theoretical maximum speed for modems designed to approach that speed and that the proposed modifications "may produce only moderate improvements in the actual performance of 56 kbps Pulse Code Modulation ("PCM") modems." NPRM at paras. 7 and 9.

[3] Throughput is affected by the number of retransmissions due to errors, which reduces the throughput, and by compression, which increases the throughput by permitting the transmission of more data in the same amount of bandwidth. For example, if the speed of transmission is 56 kbps, but every other data frame is received with errors and must be retransmitted, the throughput would be roughly 28 kbps. As another example, if the speed of transmission is 56 kbps using a 2 to 1 compression technique and experiencing no errors, the throughput would be roughly 112 kbps.

of attaining the Commission's goal "to make it possible for customers to download data from the Internet more quickly."[4]

II. It Is Premature To Propose An Increase In Signal Power, Which Could Cause Substantial Cross-Talk

The Commission seeks comments on "whether increasing the signal power risks harm to the network."[5] Increasing signal power for data risks harm to the quality of transmissions over the Public Switched Telephone Network ("PSTN"). The PSTN was originally designed for voice traffic. The proper signal power for high-quality voice traffic was designated as 0 decibels at one milliwatt ("dBm"). Analog data has a much wider bandwidth than voice and, therefore, more signal power is actually coupled into the transmission channel. Accordingly, to achieve high-quality data transmissions using the analog "voice" network, the allowable signal power for data was set 13 dB lower than voice at minus 13 dBm. This placed voice and data at equivalent signal power levels that could work side-by-side with little distortion.

Increasing the power level for data would destroy this balance and increase the likelihood of cross-talk, in which the higher-power signal "bleeds" over into the physically adjacent lower-power signal and distorts both signals. This distortion is likely to occur because increasing the power level for data so that it, in effect, exceeds the power level for voice would violate principles of equal-point power distribution among services in our copper cable plant. Increasing the power level of wider-band data transmissions without increasing

---

[4] NPRM at para. 1.
[5] *Id.* at para. 8.

the band-width capacity of our copper plant could place stress on our copper plant far beyond the accepted limits for Plain Old Telephone Service ("POTS") on the PSTN. This increased stress could frustrate our copper plant's ability to maintain the clean separation of signals, producing cross-talk.

Currently, special arrangements for data traffic are handled over private line services offered both by our competitors and by us. Private line services have unique design criteria that ensure compatibility with existing services within the same cable sheath and allow transmissions that approach the theoretical 56K modem speed. Trying to meet this speed in the PSTN, however, would introduce transmission requirements that far exceed the requirements of the PSTN and require changing published standards for the PSTN, not just changing Part 68.[6] These changes could, in effect, change the PSTN into a network designed for data, and leave voice traffic to face the risks of distortions that are at this point not quantified and not quantifiable.

This risk of cross-talk from increasing the signal power of data on the PSTN has risen substantially in recent years. With the explosion in the amount of facsimile ("fax") data traffic, there is much more data traffic now to potentially be adjacent to, and bleed into, voice traffic. The risk of cross-talk between adjacent data channels also has become significant because old modems, with lower maximum power levels, are still being used with the network at the same time as new modems, with higher maximum power levels, are being used. Increasing the network power limit to match the newer modems will increase

[6] For instance, the following would need to be changed: the InterLATA BOC notes, the LSSGR, the special services access, GR303, TR303, and T1.101.

cross-talk, as transmissions relying on new modems bleed into transmissions relying on old modems.

Additional risk of cross-talk from varying power levels, is caused by the nature of network development itself. The development of new digital network technologies offering higher transmission speeds has occurred in the same PSTN that continues to provide the POTS that is essential to maintaining universal service for our nation. These new technologies include Integrated Services Digital Network ("ISDN"), SONET, Frame Relay Service ("FRS"), and Asymmetrical Digital Subscriber Loop ("ADSL"). Modem manufacturers designate the signal power of their digital modems based on the incorrect assumption that the PSTN is totally digital except for the loops. Actually, for shorter distances, the PSTN also still includes much analog copper in both the feeder plant and distribution plant. This hybrid nature of the networks creates continuous needs for conversions back-and-forth between analog and digital. These conversions decrease network speed and increase distortion, reducing the potential benefits from increasing signal power and adding to the likelihood of cross-talk between varying network services.[7]

[7] For instance, with the introduction into our hybrid analog-digital networks of Digital Loop Carriers ("DLCs"), which have two analog-to-digital conversions before hitting a switch, we cannot meet the design criteria of the 56K modems, which require only one analog-to-digital conversion in the switched connection circuit. Also, the signal to noise ratio ("SNR") of analog switches is less than that of digital switches because of analog switched relay contacts, which inherently add a penalty in performance. SNR is computed as signal power divided by noise power. The relay contacts connect the customer to the dialed route. These connections are mechanical and change from call to call.

III. Studies And Tests Must Be Conducted First In Order To Allow Rational Review Of The Proposal To Increase Signal Power

The existing signal power limits were established only after substantial engineering studies and testing. Prior to deciding on any change, new engineering studies and testing would be required. New characterization testing would have to account for the increased complexity of both the networks and the customer premises equipment ("CPE") attached to the networks, combining both old and new technologies. Samples of a variety of communications would need to be taken at varying power levels in order to conduct performance analysis of throughput, connect speed,[8] and distortion.

The results of these tests would need to be brought to the appropriate U.S. standards bodies, where technical experts could arrive at a consensus concerning any changes in signal power or in other factors that would be appropriate. These bodies include T1A1 (performance standards), T1E1 (access technologies), and T1A TR41 (CPE access). In fact, we understand that Working Group T1A1.7 of ANSI accredited Committee T1 – Telecommunications already has developed a test plan to investigate the cross-talk generation potential of the digital modem.[9]

---

[8] Connect speed is the rate at which data is transmitted in bits per second. In digital transmission, one bit is represented by 0 for low voltage or by 1 for high voltage. In analog transmission, one or more bits are represented by specific combinations of frequency and/or voltage amplitude and/or voltage phase. Eight bits (one byte) are used to represent the binary form of the numerical codes for characters. Each character (a-z, 0-9, and special characters) have assigned numerical codes.

[9] This test plan is contained in Contribution T1A1.7\98-027r1.

IV. There Are Better Alternatives For Increasing Throughput Of Data Communications

The Commission seeks comments on whether other modifications than increasing the signal power level "would be more beneficial and entail less risk."[10] The appropriate goal is to have the most data possible move through the end user's high speed digital modem in the shortest amount of time possible ("throughput"), without causing distortion in any transmissions in the network. Although increasing signal power in the network is one way potentially to move toward meeting the goal of greater throughput, other changes can have far more positive impacts without the significant risk of distortion.

The maximum rate at which a modem operates is dependent on numerous factors in addition to signal power, including (1) the network architecture between the Internet Service Provider ("ISP") and the end user and (2) the inside wiring architecture at the customer's premises. For instance, changing the channel architecture in the network to widen the bandwidth to achieve higher symbol rates and improving Echo Return Loss ("ERL") of hybrid 2 wire to 4 wire interfaces can readily improve the data throughput of any modem at the existing signal power.[11] As an additional example, non-twisted inside wire, with 2 pair, will cross talk into the adjacent pair. Changing to twisted pair inside wire will stop the cross talk noise and improve the modem's performance.

---

[10] NPRM at para. 8.

[11] ERL is reflected in unwanted energy (echo) caused by impedance mismatches in hybrid networks.

In order to increase throughput, the following steps also should be taken:

• ISPs should always insist on digital delivery to their locations. Digital delivery will improve bandwidth and reduce analog to digital conversions, reducing noise and ensuring that the maximum connect-speeds will be between 33.6 kbps and 53 kbps.

• ISPs also should have a means of performing trunking tests between their sites and the LECs' networks to ensure acceptable ERL/SNR measurements. This testing should be switch-to-switch (router/server) and not to an external jack appearance (DSX-1). Proper pre-service line-up of ISP trunks ensures against unwanted signal loss being injected into the circuits.

• Synchronization of the ISP's facilities is also imperative. CPE vendors should review their design criteria to meet SONET requirements for Jitter and Wander (T1.403). Also, external timing capabilities should be provided in order to assist the router or server in synching up to the incoming signal and to avoid incorrectly perceiving errors in the incoming signal.

• Consideration should be given to the impact of noise within the loop caused by increasing power and to the effect of increased noise on the analog/digital hybrid network. Noise directly affects the ERL/SNR of the connection and, thus, the throughput.

• Consideration should be given to speed versus throughput, since the maximum throughput is 115 kbps which is limited by the Universal Asynchronous Receiver Transmitter ("UART") in the PC being used by the ISP's customer. This throughput can be achieved at lower speeds if there are fewer error corrections and resends.

V. Conclusion

It is premature to propose any change in network signal power. Before any change could be made without creating a substantial risk of cross-talk within telephone network transmissions, extensive engineering studies and testing would be needed, including substantial work in standards bodies. In the mean time, there are alternative methods of increasing data transmission speed and throughput much more dramatically than by increasing signal power. Moreover, other methods pose far less risk of distorting transmission quality. The

CERTIFICATE OF SERVICE

I, Vicki S. Fernandez, hereby certify that the foregoing, " Comments of SWBT, Pacific Bell and Nevada Bell," in CC Docket No. 98-163 has been filed this 29th day of October 1998, to the Parties of Record.

Vicki S. Fernandez

October 29, 1998

Commission should not adopt the NPRM's proposal, but instead should encourage the exploration and development of various means of attaining the Commission's goal "to make it possible for customers to download data from the Internet more quickly."[12]

Respectfully submitted,

SOUTHWESTERN BELL TELEPHONE COMPANY, PACIFIC BELL, AND NEVADA BELL

ROBERT M. LYNCH
175 E. Houston, Room 1250
San Antonio, Texas 78205
(210) 351-3737

DURWARD D. DUPRE
JEFFREY B. THOMAS
208 South Akard, Room 3043
Dallas, Texas 75202
(214) 464-4490

Their Attorneys

Date: October 29, 1998

[12] NPRM at para. 1.